

FORM PTO-1390 (REV. 1-98)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 46739/252170
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (If known, see 37 CFR 1.5) unknown 09/744493
INTERNATIONAL APPLICATION NO. PCT/US99/16648	INTERNATIONAL FILING DATE 22 July 1999 (22.07.99)	PRIORITY DATE CLAIMED 22 July 1998 (22.07.98)	
TITLE OF INVENTION THREADED CYLINDRICAL MULTIDISCOID SINGLE OR MULTIPLE ARRAY DISC PROSTHESIS			
APPLICANT(S) FOR DO/EO/US BRYAN, Vincent and KUNZLER, Alex			
<p>Applicants herewith submit to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. <input type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 37 (b) and PCT Articles 22 and 39(1). <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> has been transmitted by the International Bureau. <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). <input type="checkbox"/> A translation of the published International Application into English (35 U.S.C. 371(c)(2)). <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input checked="" type="checkbox"/> have not been made and will not be made. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)). <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (unexecuted) <input type="checkbox"/> A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.197 and 1.98 <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. <input type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. <input type="checkbox"/> A substitute specification. <input type="checkbox"/> A change of power of attorney and/or address letter. <input checked="" type="checkbox"/> Other items or information: <ol style="list-style-type: none"> Certification Under 37 CFR 1.10 <p>I hereby certify that this document is being mailed to Box PCT, Assistant Director for Patents, Washington, D.C. 20231, via "Express Mail Post Office to Addressee" on this 22nd day of January, 2001, Express Mail Label No. EL67000846 US</p> <p><i>Angela M. Rossi</i> Angela M. Rossi</p>			

09/744493


U.S. APPLICATION NO. (if not known, 37 CFR 1.5) unknown		INTERNATIONAL APPLICATION NO. PCT/US99/16648		ATTORNEY'S DOCKET NUMBER 46739/252170	
17. <input checked="" type="checkbox"/> The following fees are submitted BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2) paid to USPTO \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	21	01	X \$18.00	\$18.00	
Independent claims	06	03	X \$78.00	\$234.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$0.00	
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Reduction of 1/2 for filing by small entity, if applicable.				\$(471.00)	
SUBTOTAL =				\$471.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$0.00	
TOTAL NATIONAL FEE =				\$471.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40 per property				\$0.00	
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				charged:	\$

a. ☒ Check in the amount of \$471.00 is enclosed.

b. ☐ Please charge my Deposit Account No. 11-0855 in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

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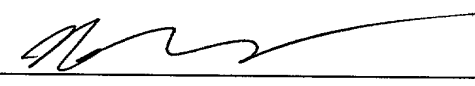
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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SPECIFICATION

09/7/03

TITLE**THREADED CYLINDRICAL MULTIDISCOID SINGLE OR
MULTIPLE ARRAY DISC PROSTHESIS**

5

This invention relates to the design and use of a unique disc prosthesis for the lumbar, thoracic and cervical spine.

U.S. Patent 5,674,296 is incorporated by reference.

BACKGROUND OF THE INVENTION

10 Degenerative disc disease including disc herniation may produce disabling symptoms of local pain, radiculopathy or myelopathy in an otherwise clinically stable spine, which proves to be unresponsive to non-surgical treatment. Several surgical treatments are available to address the symptoms of degenerative disc disease when non-invasive therapies are not effective. These surgical treatments include decompression,
15 discectomy and fusion. These treatments, and in particular the discectomy and fusion procedures, provide relief of clinical symptoms but they do not restore normal or near normal range of motion or cushioning to the affected functional spinal unit (FSU). This can result in acceleration of the degenerative process in spinal discs adjacent to the original surgical operation site. This degenerative process can, in turn, require additional
20 surgical intervention.

Open surgery and endoscopic techniques are often used to provide access to the targeted intervertebral disc space. Posterior, postero-lateral, and anterior approaches allow placement of instrumentation to facilitate exposure of the degenerated disc and the insertion of bone grafts or fusion cages to accomplish bony fusion.

25 Because of anatomical structure considerations and instrument size restrictions associated with minimally invasive surgical techniques in the anterior spine, the insertion of a functional disc prosthesis equal in size to the natural disc creates risks due to mechanical interferences with critical vascular structures and may prevent safe insertion of the prosthesis.

30 A functional disc prosthesis which provides for a full range of motion of the FSU and for cushioning between two adjacent vertebrae while maintaining stability,

intervertebral body spacing and lordosis, is desirable, more specifically it is an object of the invention to provide a disc prosthesis having a small or narrow profile. The novel exemplary prosthesis is cylindrical in exterior shape, comprised of two longitudinally split halves. Each housing half is separated from the other at all times by disk shaped resilient bodies contained therein, and is strong enough to support the loads to which it shall be subjected during the activities of daily living. The housing contains multiple concave articulation recesses capable of mating with the discoid resilient bodies placed therebetween. The discoid bodies are of smaller diameter than the natural disc they replace, and are positioned in series in the shells or articulation recesses contained in the interior of the cylindrical housing. The cylindrical housing is threaded on its exterior for ease of introduction into, and mechanical stability in, a prepared space in the opposing vertebrae of the FSU. The housing is configured to fit the restrictions imposed by the limited anatomical space available for the surgical placement of the implant, and is small so as to utilize implantation procedures and instrumentation such as those used in an endoscopic procedure.

It is a further object of the invention to provide cylindrical housings of differing size, and resilient bodies contained within, so that when the cylindrically shaped prostheses units are used in parallel, they may facilitate proper positioning of opposing vertebrae.

Another object is to obviate the need for a second surgical site for bone graft harvesting.

And it is a further object of the invention to provide a sheath so as to completely surrounded and enclose the space occupied by the resilient bodies between the two cylindrical housing halves.

Still another object of the invention is to provide a disc prosthesis which will permit motion between the housing halves.

A further object of the intention is to provide a disc prosthesis which will provide for cushioning between the housing halves.

It is a still further object of the invention to provide a disc prosthesis which may be used alone or in parallel array with similar prostheses.

Other objects and advantages of the invention will become apparent to those skilled in the art upon reading the following detailed description and upon reference to the drawings. Throughout the drawings, like reference numerals refer to like parts.

5 DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of the novel disc prosthesis.

Figure 2 is a sectional view taken substantially in the plane of line 2-2 in figure 1.

Figure 3 is a sectional view taken substantially in the plane of line 3-3 in figure

10 2.

Figure 4 is an isometric view similar to figure 1 but showing an alternate embodiment of the invention.

Figure 5 is a sectional view taken substantially in the plane of line 5-5 in figure 4.

15 Figure 6 is a sectional view taken substantially in the plane of line 6-6 in figure 5.

Figure 7 is an isometric view of a lower half housing of the invention.

Figure 8 is a top plan view of the lower half housing shown in figure 7.

Figure 9 is a sectional view taken substantially in the plane of line 9-9 in figure

20 8.

Figure 10 is a sectional view taken substantially in the plane of line 10-10 in figure 9.

Figure 11 is a top plan view of a lower half housing similar to figure 8 but showing and alternate embodiment of the invention.

25 Figure 12 is a sectional view similar to figure 9 but taken substantially in the plane of line 12 – 12 in figure 11.

Figure 13 is an isometric view of the lower half housing shown in figures 11 and 12.

Figure 14 is a sectional view taken substantially in the plane of line 14 – 14 in figure 12.

30 While the invention will be described in connection with a preferred embodiment,

it will be understood that it is not intended to limit the invention to this embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

5 To accomplish the objectives set out above, the novel exemplary disc prosthesis 10 includes, as shown in figures 1 and 4, a cylindrical housing 20. The housing 20 includes an upper half housing 22 and a lower half housing 24. In the embodiment showed in figure 1, an upper fixator wing 26 is welded or otherwise associated with the upper half housing 22, and a lower fixator wing 28 is similarly welded or otherwise
10 associated with the lower half housing 24. These wings 26, 28 can be used to stabilize the prosthesis to bone, as suggested in U.S. Patent 5,674,296. The wings 26, 28 can be omitted, as suggested in figures 4 - 14.

As particularly shown in figures 2, 3, 5 and 6, a plurality of resilient, viscoelastic discs 41, 42 are interposed between the upper half housing 22 and the lower half housing
15 24 to maintain the housing halves separate from one another and to provide for a defined range of motion. Alternatively, the discs 41, 42 may be made of a suitable hydrogel. If desired, generally conical bosses or posts 29 can fit into recesses 33 formed in the discs 41, 42 to provide stability and limitation against excessive motion.

The housing 20 has an exterior surface 30 which bears a screw thread shape 31.
20 This screw thread shape 31 is continuous, and is contiguous from housing half 22 to housing half 24 so that the disc prosthesis can be screwed into a pre-tapped intervertebral space hole formed within between two adjacent vertebrae as, for example, in the human spine. If desired, recesses 35 can be formed to permit bone ingrowth and further stabilization of the device. The housing 20 shape can be that of a right cylinder or it can
25 be conical.

In accordance with one aspect of the invention, this small or thin profile prosthesis 10 can be created by placing more than one ovoid resilient prosthetic discs 41, 42 within a cylindrical housing 20 of metal, ceramic or polymeric material (the housing 20 having been separated into two halves 22, 24 longitudinally). This small device 10 can
30 be implanted in the spine through a small surgical opening. One device 20 containing two or more discs 41, 42 may be used, or by placing two such devices 20 in parallel, each

containing two or more ovoid discs in series, a full range of motion of the functional spinal unit (FSU) can be achieved. If the discoid material possesses resilient, viscoelastic properties, with the housing being split or otherwise open on its sides with the internally placed ovoid discs maintaining the separation of the upper and lower housing members, a cushioning effect may also be realized. If desired, a flexible sheath or seal can be attached to the housing halves, as by a retaining wire or band, as suggested in U.S. Patent 5,674,296.

As suggested in figures 7 - 10, each ovoid disc 41, 42 may be surrounded by a concave surface 51, 52 formed or contained within the housing, and contoured to accept the upper and lower surface shape of each of the ovoid discs 41, 42 so that the housing 20 comprising the two or more halves or paired shells 23, 24 may slide and/or rotate over the surface of the discs 41, 42 to provide for joint space separation and motion.

As suggested in figures 11-14, a single recess 61 can be provided to accommodate both discs 41, 42. If desired, posts 29 can be provided to limit disc - housing half relative motion.

As noted above, the exterior surface of the split housing 20 has a threaded formation so that it may be screwed into a pre-tapped hole of appropriate size at an intervertebral, disc space. When properly screwed into place, the upper half of the threaded housing engages the cephalad vertebral bone inferior end plate and the other half 24 of the threaded housing engages the opposing superior end plate of the caudal vertebral bone when fully inserted. The ovoid discs 41, 42 and their respective concave surfaces in any one housing unit may be of differing size so as to allow for appropriate spinal column curvature, especially when inserted in the anterior/ posterior direction, or they may be the same size in any one housing but differ from the size of the discs in the second housing placed in parallel when inserted from a lateral direction.

The device may be inserted via open or minimally invasive techniques including endoscopy, or by a variety of known surgical approaches where adequate anatomical space is available. Though the prosthesis is inserted as a single threaded cylindrical unit, its final position is such that one half of the housing is left exclusively in contact with the end plate of one vertebral body and the other in the exclusive contact of the opposing vertebral body end plate. The discoid vertebral bodies between the cylindrical housing

halves contain two or more concave surfaces, allow movement by providing for sliding and rotating in multiple directions and cushioning in response to physiological loads placed upon them. When cylinders of different size are at used in parallel, intervertebral spacing can be varied to achieve desired vertebrae positional relationships.

I CLAIM:

1. A disc prosthesis comprising, in combination, a cylindrical housing, the housing including an upper half and a lower half and a plurality of resilient, viscoelastic
5 discs interposed between the upper half housing and the lower half housing to maintain the housing halves separate from one another.
2. A disc prosthesis according to claim 1 wherein said discs are ovoid in shape.
3. A disc prosthesis according to claim 1 wherein each disc is partly surrounded by a concave surface formed within said housing.
- 10 4. A disc prosthesis according to claim 1 wherein said housing has a threaded exterior surface bearing a screw thread shape.
5. A disc prosthesis according to claim 4 wherein said screw thread is continuous, and is contiguous from housing half to housing half so that the disc prosthesis can be screwed into a pre-tapped intervertebral space hole.
- 15 6. A disc prosthesis according to claim 1 wherein recesses are defined in said housing to permit bone ingrowth.
7. A disc prosthesis according to claim 1 including a wing member attached to each of the upper and the lower half housing members, the wings permitting the housing halves to be affixed to spinal vertebrae.
- 20 8. A disc prosthesis affixed within a human spine, the prosthesis comprising an upper half housing engaging the cephalad vertebral bone inferior end plate; a lower half housing engaging the caudal vertebral bone superior end plate; and a plurality of separate, resilient discs interposed between the housing halves.
9. A disc prosthesis according to claim 8 wherein each disc is partly surrounded
25 by a concave surface formed within one of said housing halves.
10. A disc prosthesis according to claim 8 wherein each housing half has a threaded exterior surface.
11. A disc prosthesis comprising, in combination, a hollow cylindrical housing, the housing including two separate halves and at least one prosthetic disc located between
30 the two housing halves.

12. A disc prosthesis according to claim 11 in which each housing half is at least partly defined, in its interior, by a concave surface.

13. A plurality of disc prostheses located within a human spine , each prosthesis comprising an upper half housing engaging a cephalad bone inferior end plate; a lower
5 half housing engaging a caudal vertebral bone superior end plate; and at least one resilient disc interposed between each of the housing halves.

14. A plurality of disc prostheses according to claim 13, each prosthesis having a threaded exterior surface.

15. A plurality of disc prostheses according to claim 14 wherein each prosthesis
10 has recesses defined in its exterior surface to permit bone ingrowth.

16. A viscoelastic prosthetic disc for use in a human spinal implant, the disc having viscoelastic properties similar to the natural biological disc found in the human spine, the prosthetic disc having convex external surfaces for sliding engagement with concave surfaces formed on the interior of rigid upper and lower half housings

15 17. The disc of claim 16 wherein said disc has a relatively soft and resilient interior and a relatively hard and durable exterior.

18. A disc prosthesis comprising, in combination, a housing, the housing having an exterior surface defining a general continuous thread formation, the housing including at least two rigid, confronting and complimentary parts, the prosthesis further comprising
20 at least one resilient, viscoelectric disc interposed between the housing parts to maintain the housing parts separate from one another but to provide cushioning between the housing parts and to permit limited motion from between the housing parts.

19. A disc prosthesis according to claim 18 wherein the housing thread is adapted to engage the bone of adjacent vertebral bodies.

25 20. A disc prosthesis according to claim 18 including a sheath attached to said housing halves.

21. A disc prosthesis according to claim 18 including a plurality of nuclei of different sizes.

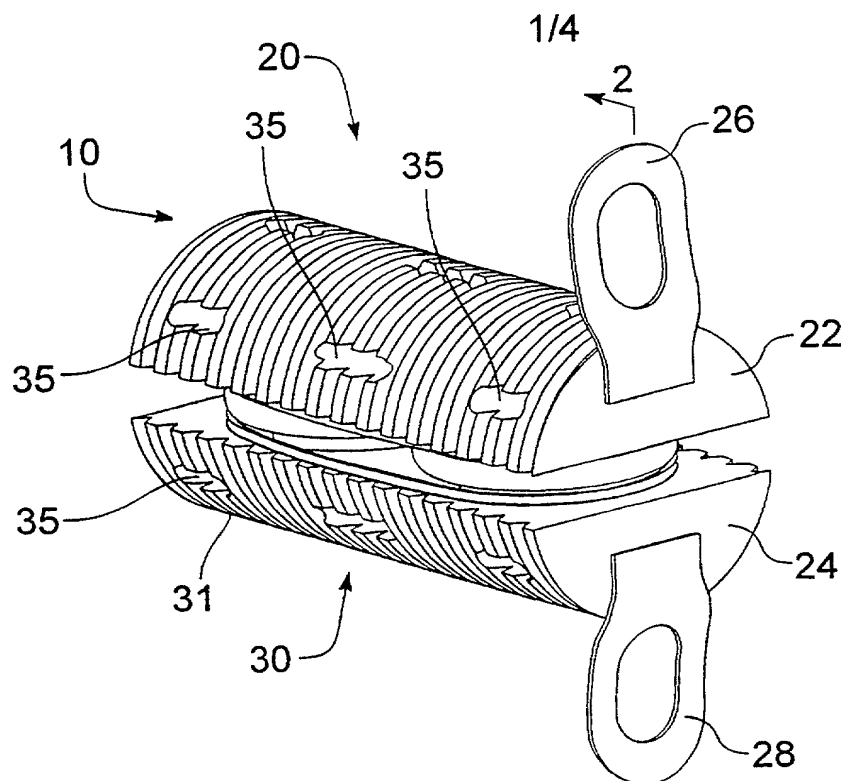


FIG. 1

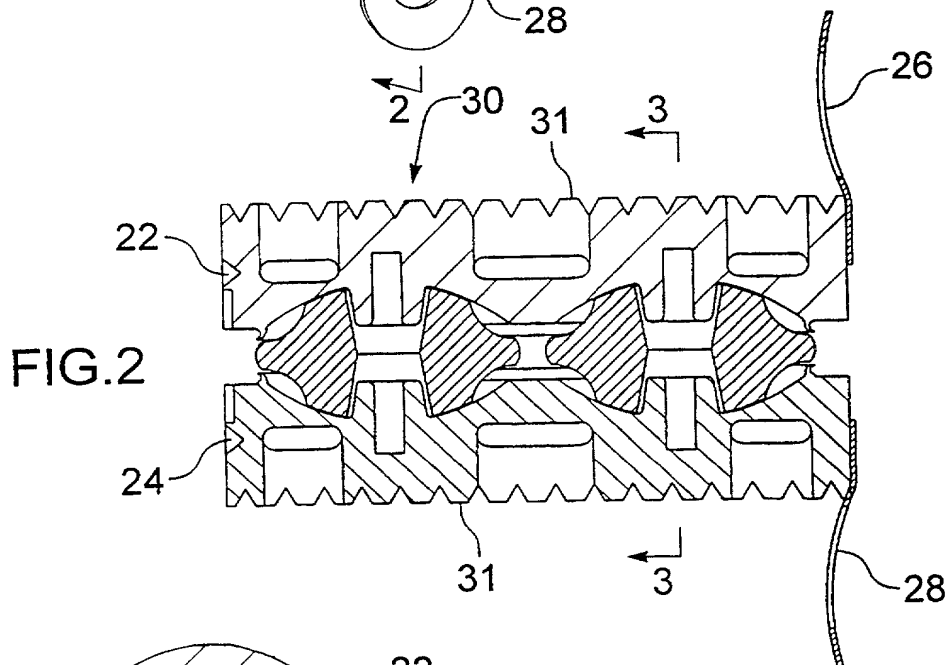


FIG. 2

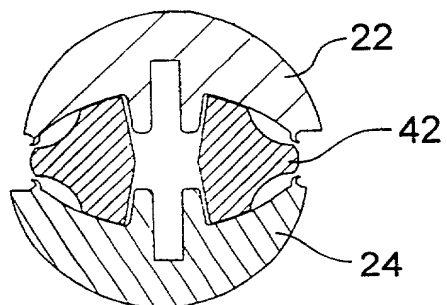
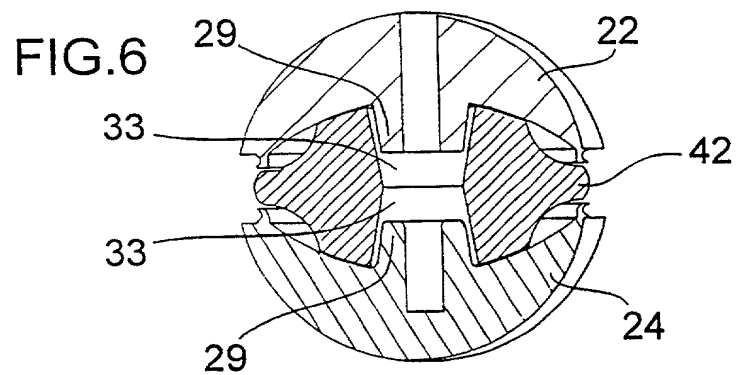
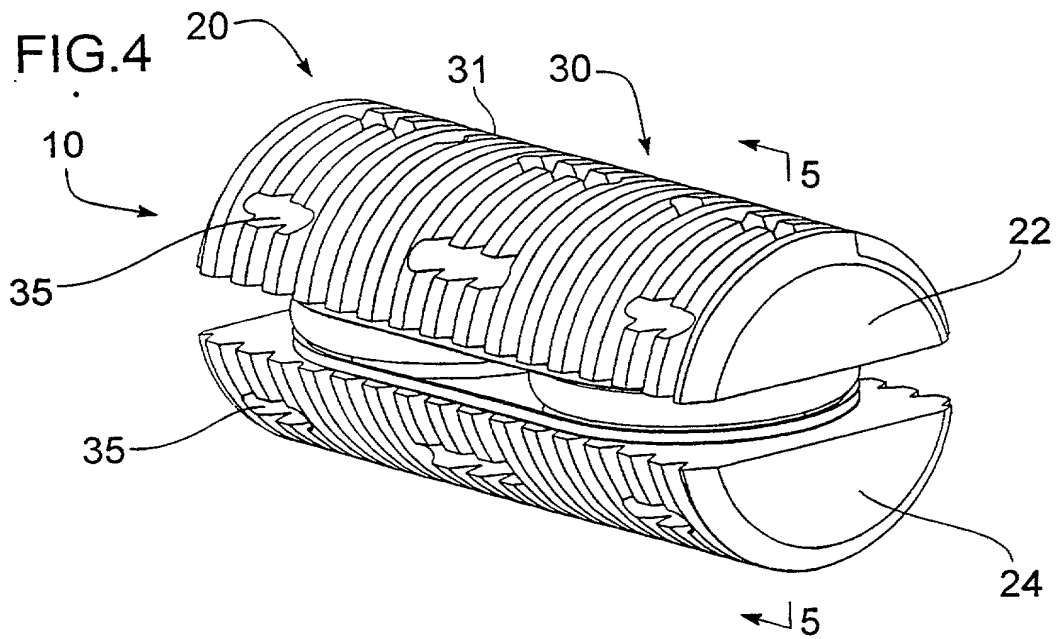
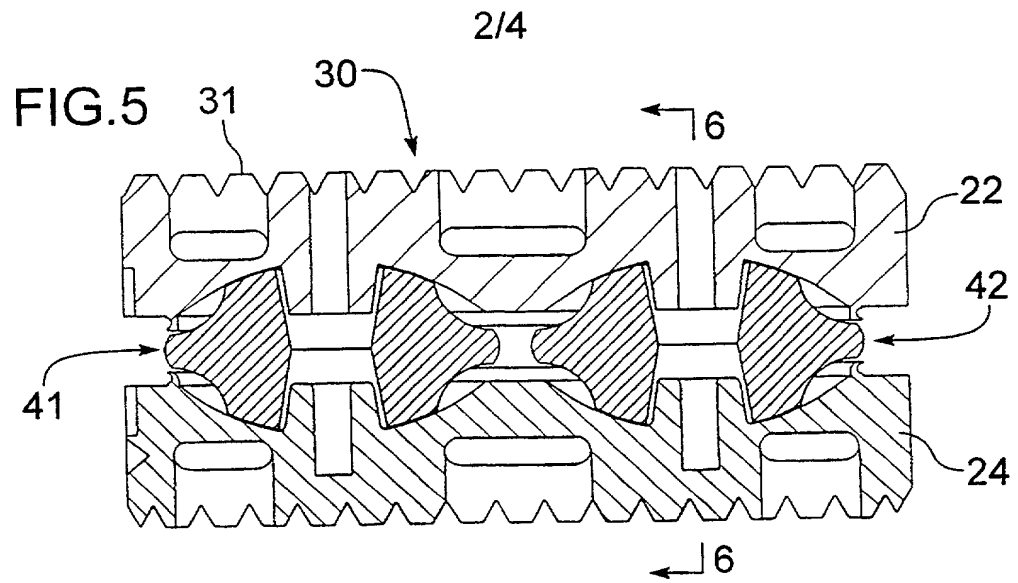
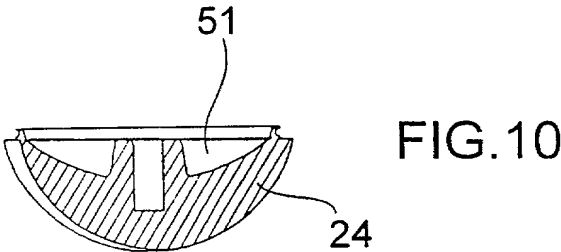
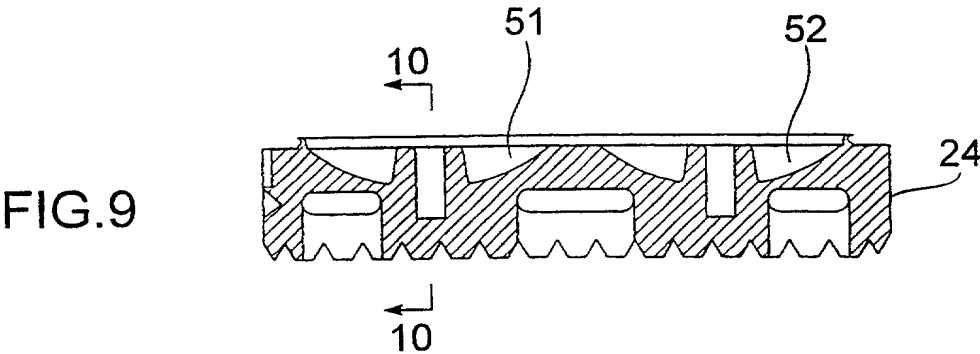
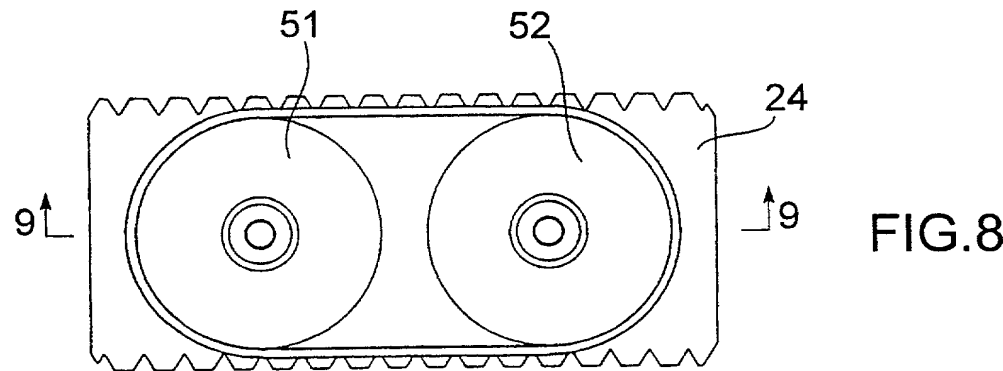
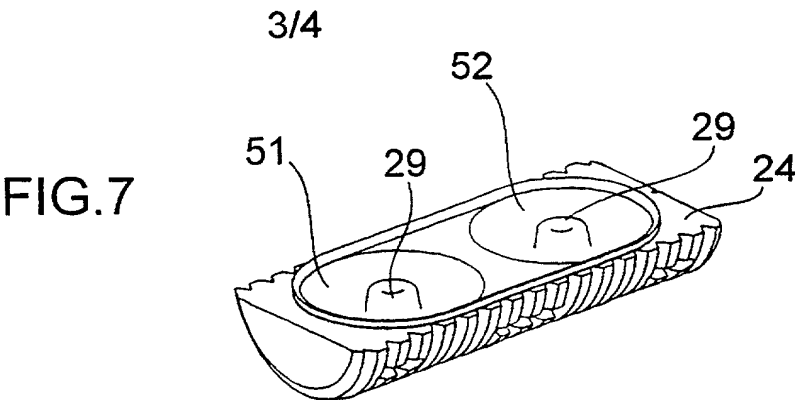


FIG. 3





4/4

FIG.11

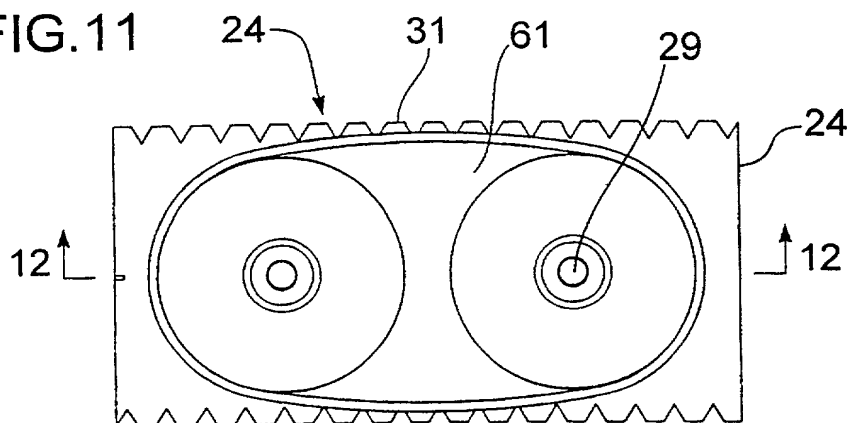


FIG.12

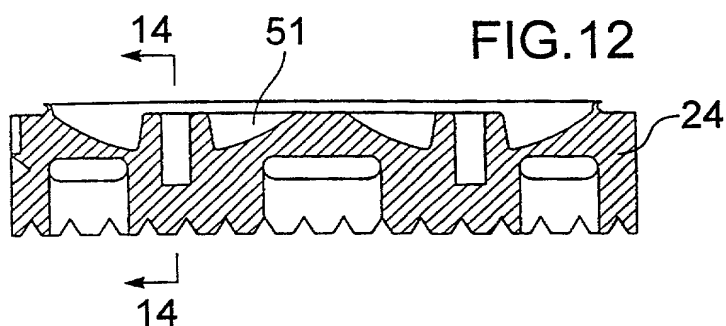


FIG.13

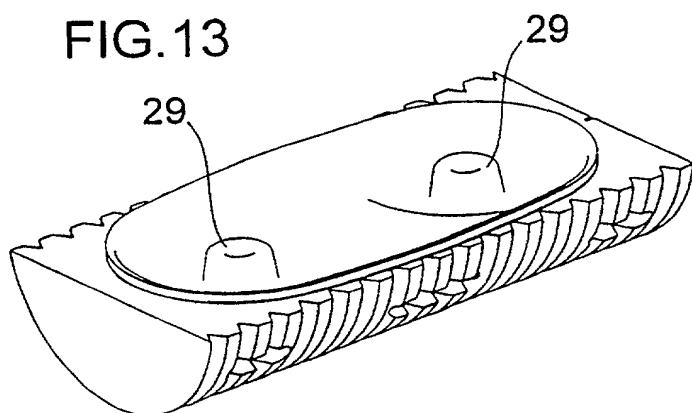
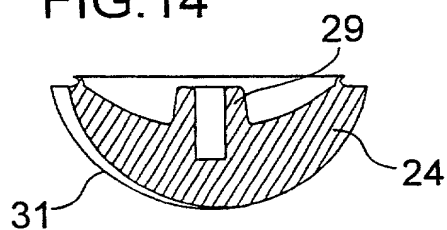


FIG.14



U.S. National Phase of PCT/US99/16648

Inventors: Vincent BRYAN and Alex KUNZLER

Filed: 22 January 2001

For: "Threaded Cylindrical Multidiscoid Single or Multiple Array Disc Prosthesis"

Declaration for Patent Application

Page 2

As a named inventor, I hereby revoke all prior powers and appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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S. Craig Hemenway	<u>44,759</u>
Kristin L. Johnson	<u>44,807</u>
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Kyle M. Globberman	<u>46,730</u>
Tywanda L. Harris	<u>46,758</u>
Kristin D. Mallatt	<u>46,895</u>
Cynthia B. Rothschild	<u>47,040</u>
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Geoffrey K. Gavin	<u>P47,591</u>

I acknowledge the above-listed attorneys and agents and their firm Kilpatrick Stockton LLP represent my employer (if I am an employee and this application has been or will be assigned to my employer) or the entity with which I have contracted (if I am an independent contractor and this application has been or will be assigned to such entity) and in such cases do not represent me individually. I further acknowledge I have not established, nor will I seek to establish, any personal attorney/client relationship with Kilpatrick Stockton LLP in connection with this application and understand that, should I require legal representation, I will obtain such, at my expense, other than through Kilpatrick Stockton LLP.

DECLARATION FOR PATENT APPLICATION☒ Original☐ Supplemental☐ Substitute☐ PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below), or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Threaded Cylindrical Multidiscoid Single or Multiple Array Disc Prosthesis

(Title of the Invention)

the specification of which (check one)

☐ is attached hereto☒ was filed on 22 July 1999 as PCT International Application Number PCT/US99/16648

and was amended

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 (a) - (d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified, by checking the box below, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications			Priority Claimed		Copy Attached	
Application Number	Country	Foreign Filing Date (MM/DD/YYYY)	YES	NO	YES	NO

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below and claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Parent Application Number	Filing Date	Status (Mark Appropriate Column Below)		
		Patented	Pending	Abandoned
60/093,654	July 22, 1998 (07/22/98)			X

U.S. National Phase of PCT/US99/16648

Inventors: Vincent BRYAN and Alex KUNZLER

Filed: 22 January 2001

For: "Threaded Cylindrical Multidisoid Single or Multiple Array Disc Prosthesis"

Declaration for Patent Application

Page 3

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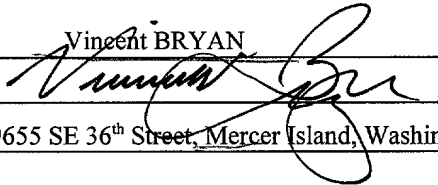
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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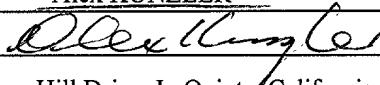
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